

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference XA1624		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB 02/05733	International filing date (day/month/year) 17.12.2002	Priority date (day/month/year) 02.01.2002	
International Patent Classification (IPC) or both national classification and IPC H02M3/158			
Applicant BAE SYSTEMS PLC et al.			

<p>1. This International preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 10 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of    sheets.</p>	
<p>3. This report contains indications relating to the following items:</p> <p>I    <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II   <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input checked="" type="checkbox"/> Lack of unity of invention</p> <p>V   <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>	

Date of submission of the demand  07.06.2003	Date of completion of this report  07.04.2004
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**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/GB 02/05733**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-27 as originally filed

**Claims, Numbers**

1-37 as originally filed

**Drawings, Sheets**

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
- (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:
- ☐ the entire international application,
  - ☒ claims Nos. 12,14-16,23-37  
because:
    - ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):
    - ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 2-4 are so unclear that no meaningful opinion could be formed (*specify*):  
**see separate sheet**
    - ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
    - ☒ no international search report has been established for the said claims Nos. 12,14-16,23-37
2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:
- ☐ the written form has not been furnished or does not comply with the Standard.
  - ☐ the computer readable form has not been furnished or does not comply with the Standard.

**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

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☐ complied with.

☒ not complied with for the following reasons:

**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☐ all parts.

☒ the parts relating to claims Nos. 1, 8, 13, 33-37 .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1, 8, 13, 33-35
Inventive step (IS)	Yes: Claims	
	No: Claims	1, 8, 13, 33-35
Industrial applicability (IA)	Yes: Claims	1, 8, 13, 33-35
	No: Claims	

2. Citations and explanations

**see separate sheet**

1. Reference is made to the following document of the search report:

D1: WO 98 39787 A (MANNESMANN REXROTH AG) 11 September 1998  
D9: DE 197 28 318 C (DAIMLER-BENZ AKTIENGESELLSCHAFT) 1 April 1999  
D10: US-B1-6 194 883 (HIROSHI SHIMAMORI) 27 February 2001  
D11: PATENT ABSTRACTS OF JAPAN vol. 1999, no. 08, 30 June 1999 & JP 11 069629 A (NISSIN ELECTRIC), 9 March 1999

2. Referring to Fig. 1 and page 1, lines 25 et seq. of the application, a switching circuit is known according to lines 1-6 of present claim 1 comprising
- an input operable to receive a DC signal of  $+V_S$ ,
  - an output,
  - first and second switches operable in response to first and second switching signals to be switched between on and off states such that switching between various combinations of on and off states produces an electrical signal at the output with voltage pulses at levels of  $+V_S$ , 0V and  $-V_S$ .

- 2.1 In lines 6 and 7 of current claim 1 a **voltage sensor** is defined for producing a signal indicative of a voltage offset in the switching circuit.

This feature, however, is rather vague and broad. It does not specify where this sensor is arranged and which voltage is the reference for determining the offset, in particular, it does not define that the voltage (offset) of the DC input signal is measured.

Otherwise stated, every voltage sensor produces a signal which is indicative of a voltage difference or offset.

- 2.2 Moreover, claim 1 does not specify how the voltage offset caused by
- fluctuations in the DC supply about the nominal value of  $+V_S$ ,
  - voltage drops across the diodes and transistors caused by their intrinsic resistance, and
  - slow response times in the components (cf. application bottom of page 2)
- is evaluated and used to correct the variations in the voltage supplied to the electromagnet which would fall behind the required variation if not corrected.

- 2.3 Regarding the prior art described in the application, it is stated in the phrase bridging page 1 and 2 of the description that a current or **voltage demand** will be received and switching signals are generated **to match this (voltage) demand**.

It is further specified in the application on page 1, lines 13-19 that the current controller can be operated in response to force demands, although this must be converted into a current or voltage demand ... and so the term "current controller" is used to cover operation in response to **voltage** or current or field **demands**.

Thus, the known switching circuit is provided with means defining a voltage demand (cf. claim 13 (a): "voltage demand signal indicative of a desired voltage") and control means measuring the actual voltage and controlling the switching signals such as to match the voltage demand (cf. claim 13 (b): generating ... switching signals with reference to the voltage demand signal and with reference to a voltage offset in the switching circuit" and claim 13, page 30, lines 5-7: "the ... switching signals being generated such that an average voltage of the electrical signal supplied to the output during the period is substantially equal to the desired voltage").

Otherwise stated, a **voltage sensor** is defined for producing a signal indicative of a voltage offset in the switching circuit, as defined in claim 1, lines 6 and 7.

- 2.4 Moreover, present claim 1 does define the essential features which would allow to overcome the problem(s) discussed in the paragraph bridging page 2 and 3 of the application.
- 2.5 Document **D1**, cf. Fig. 1 and 2, discloses a switching circuit (current-controlled output stage) for electromagnetic actuators with a current controller and a power section. This switching circuit also comprises
- an input operable to receive a DC signal of  $+U_v$ ,
  - an output (to supply current to an electromagnet 1),
  - a half-bridge including first and second switches (2, 3) (and freewheeling diodes 5 and 6) operable in response to first and second switching signals (15, 16 and 23) to be switched between on and off states such that switching between various combinations of on and off states produces an electrical signal at the output with voltage pulses at levels of  $+U_v$ , 0V and  $-U_v$ , and

- a voltage sensor (4, 7, 8; 17, 18) for producing a signal indicative of a voltage offset ( $u_{17}$  and  $u_{4L}/u_{4F}$ ) in the switching circuit.

2.6 Hence the subject-matter of independent claim 1 lacks novelty with regard to the prior art contained in the application and the teaching of D1.

Also the subject-matter of **claim 8** does not fulfil the requirement of novelty in respect of either prior art.

3. **Independent method claim 13** defines the steps of

- a) receiving a voltage demand signal indicative of a desired voltage of an electrical signal to be supplied to the output in a period;
- b) generating first and second switching signals with reference to the voltage demand signal and with reference to a voltage offset in the switching circuit; and
- c) applying the first and second switching signals to the first and second switches respectively during the period;

wherein the switching signals cause the switches to switch between on and off states, switching between various combinations of on and off states of the first and second switches producing an electrical signal at the output with voltage pulses at levels of  $+V_s$ ,  $0V$  and  $-V_s$ ,

the first and second switching signals being generated such that an average voltage of the electrical signal supplied to the output during the period is substantially equal to the desired voltage.

3.1 The subject-matter defined by claim 13 is completely silent on the aspects discussed in above paragraph 2.2, namely evaluation of the fluctuations in the DC supply and correction of the variations in the voltage supplied to the electromagnet which would fall behind the required variation if not corrected.

3.2 Hence, the arguments presented in view of claim 1 and the legal consequence(s) resulting therefrom (cf. above paragraph 2.3 - 2-5) apply mutatis mutandis to the subject-matter of claim 13.

4. **Claim 2**, dependent on claim 1, merely specifies that fluctuations in the DC signal are measured. The aspects discussed in above paragraph 2.2 are not addressed.

**Claims 3 and 4**, whereby claim 3 is dependent on claim 1, only define the result to be achieved in vague terms leaving the skilled person in doubt about the subject-matter for which protection is sought.

**Claim 5**, also dependent on claim 1, only refers to a voltage drop across a diode and/or transistor in the switching circuit without addressing the aspects discussed in above paragraph 2.2.

**Claim 8 and 12**, also dependent on claim 1, do not define any details about evaluation and correction of disturbing variations.

**Claims 14 and 17**, dependent on method claim 13, only define the result to be achieved, namely to compensate for fluctuations in the DC supply (claim 14) and to compensate for a voltage drop across a diode and/or transistor in the switching circuit (claim 17) without defining the necessary steps of evaluation and correction.

Also **claims 19, 20, 23 and 30**, each dependent on claim 13, do not contain a solution to the problem underlying the application.

Hence, these claims lack unity (a posteriori) because they comprise features which relate to different aspects of a switching circuit and related methods which do not form a single general inventive concept (Rule 13.1 PCT).

5. A computer program as defined in **claims 33-35** is known from D1, page 8, lines 25-31 (programmierte Recheneinrichtungen).  
The subject-matters of these claims therefore lack novelty.
6. The subject-matter for which protection is sought cannot be defined by a claim drafted like **claims 36 and 37**. The exception specified in the Guidelines III-4.10 does not apply in the present case.
7. The international search report cites documents D9, D10, D11 and specifies that these documents are relevant to claims 3 and 4, i.e. relevant to the prediction of the value of a DC signal using a finite impulse response filter.



7.1 The background of suggesting a FIR filter is discussed on page 16, line 8 - page 17, line 3 of the **application**: "Signal-processing delays mean that direct feedthrough of fluctuations in the filtered DC supply 22 would arrive at the switching signals generator 28 too late to provide effective compensation. Hence, the feedforward predictive voltage sensor system 34 is used. ... The FIR filter 86 is used to predict the likely value of  $1/V_s$  across the next period and passes this value as the voltage sensor signal 30 to the switching signals generator 28 such that weight can be added or subtracted to the voltage pulse width 44 proportionate to an expected increase or decrease in voltage respectively."  
Thus, the sensor system of the application provides an **estimated value** of the present input voltage signal.

7.2 Document **D9** deals with the suppression of DC voltage components in a converter. It is suggested to measure and suppress the DC components in the input current of the converter. D9 solves this problem by averaging the current during one period of the input current of measuring the input current to a converter with sufficient accuracy by using a FIR-filter (cf. page 3, lines 11 - 23).

The first embodiment of document **D10** concerns the evaluation of the input voltage and the compensation of fluctuations of the input voltage by modifying the parameters A, B and C of the FIR filter 52 in the operation unit 50 which obtains and outputs the on-time (duty-cycle) of the pulse signal provided for the switching element 13 (cf. Fig. 2, 4, 5, 10, 11 and column 2, line 10 - column 3, line 28, column 5, line 41 - column 8, line 48, column 9, line 10 - column 10, line 12 and column 12, line 52 - column 15, line 54). The second embodiment relates to the reducing of ripple in the power supply apparatus (cf. column 18, lines 52 et seq.).

Document **D11** discloses a system bus 1 for supplying a current to a load 4 which current includes harmonic components. These components are suppressed by means of a FIR-type adaptive filter 11 which controls an inverter 3 injecting a correction or compensating current  $I_a$  into the system bus.

7.3 Present claims 2 - 4 (see also above point 4) are not clear because they do not teach the skilled person the essential features or topology of the circuitry according to the invention and therefore do not define the subject-matter for which protection is sought.

Instructing the skilled person to produce an estimated DC signal by using a FIR filter, does not provide him sufficient information, for solving the problem discussed at the bottom of page 2 without the exercise of inventive skill.

The prior art D9 - D11 does not seem to render obvious the solution presented on page 16 - page 17, line 3.